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DressMe: A virtual supermarket of clothing stores

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BACHELOR'S THESIS | ABSTRACT

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Abstract

DressMe: A virtual supermarket of clothing-stores

DressMe has been proposed to be a web-shop which includes several other web-shops. Therefore, it is designed to be a virtual supermarket for clothing stores. There are many technological developments on going regarding virtual clothing. The most challenging part of these advancements however has always been in meeting basic customer demands. Clothing in general is a process of selecting best the possible outfits based on the look-and-feel approach. Unfortunately, the most recent technologies used are lagging behind to practically address these issues.

The thesis work has sighted these problems as a major topic. As a result of studying different behaviors of online clothing web-shops, a simple and effective web-shop of web-shops has been proposed. This project has emphasized the use of two different technologies as an option to create most realistic customers' or products' 3D models. In addition to these, customers can select different outfits from various web-shops, store them in their virtual dressing room and purchase them according to their wish. At the same time, the problems related to webcam adjustment have been completely eradicated.

E-commerce has been a fast growing market at present because of open Internet platform. As a result, the large companies are taking advantage and exploiting the market situation. Hence, this project has been conducted to provide a common platform for different web-shops and to create equal opportunities for all.

FOREWORD

The world has become narrower and closer every day because of new inventions in the field of Internet technologies. Among them, online clothing shops have been a heated topic for a decade. While finding out and trying different web-shops, I found that there is a need to find better solution. In the course of my studies, I also found out that there is a growing dissatisfaction and confusion among online shoppers regarding purchasing clothes online. It is because the clothes do not look and feel same as they appear in the web-shop. Also, in most of the cases they do not fit the customers.

Hence, I understood that there is a demand for a very simple application which would address these issues. While looking at different possibilities, I found out that it is possible to use simple technologies, and integrate them into a system. Doing this would help to reach a better solution. Hence, a simple conceptual model was presented to instructor Mr. Granholm. He found and understood the importance of the topic, and allowed me full freedom to approach and collect resources for further studies.

However, the completion of this project took quite a long time. There has been situation when I felt that I would never be able to present and document my ideas. But, special thanks go to Mr. Granholm for his continuous support.

Lastly, I am happy to present and excitingly wait for the feedback this project work generates. I hope by the will of God, this work could be a milestone for the future of online clothing stores.

08.12.2011 Turku

Barun Bashyal

CONTENTS

FIGURES

NOTATIONS

2D	Two Dimensional
3D	Three Dimensional
AR	Augmented Reality
B2B	Business to Business
CCD	Charge Coupled Device
CEM	Camera Ego Motion
CMOS	Complementary Metal Oxide Semiconductor
CPE	Camera Pose Estimation
DA	Data Administrator
DBA	Database Administrator
DBMS	Database Management System
FRAP	Facilitated Risk Analysis Process
GUI	Graphic User Interface
OS	Operating System software
PIM	Product Information Management
ProFORMA	Probabilistic Feature-based On-line Rapid Model Acquisition
SDP	Software Development Process
SDLC	Software Development Life Cycle
SFM	Structure from Motion
SLAM	Simultaneous Localization and Mapping
SRS	System Requirement Specification

SEO	Search Engine Optimization
UML	Unified Modeling Language
USB	Universal Serial Buss
UVC	USB Video device Class
VGA	Visual Graphic Adaptor
WWW	World Wide Web

1 Introduction

The number of Internet users has increased to 2.1 billion, which is nearly one third of Earth's population as of 2011 [1]. Since the advent of the Internet the world has become narrower day by day, and now it has affected every aspects of human life. Among them, the world of online Internet business has been the most prominent one. The history of online business goes back just two decades. In 1990 Tim Berners-Lee created the first WWW server and browser, and it was opened for commercial use in 1991. Then, several advances in this field took place. In 1994, Netscape introduced SSL encryption of data transferred online, which has become essential for secure online shopping. During the same year, the German company "Intershop" introduced its first online shopping system in Europe. By 1995, Amazon launched its shopping site, and in 1996 the online auction company "eBay" appeared. Since then, "e-commerce" has been flourishing in unstoppable manner. It means just more than buying and selling products online. Now, one can use this in the entire process of online developing, marketing, selling, delivering, servicing, paying as well as administrating. At the moment, there are numerous successful online companies, operating e-business in different fields from social media marketing (Facebook), search engine & SEO (Google) to B2B deals (GroupOn) [2].

In the present market it is possible to find web-shops for any kinds of products. The web-shops for online retailers as well as wholesalers of clothes are available everywhere on the Internet. In the meantime, the way of shopping online, having a virtual cloth stores, selecting and delivering different cloth items have become common. Now, it is possible to make a 3D tour of any cloth stores, and their items. Recently new technologies such as use of body scanners, Augmented Reality (AR), and different 3D modeling software have improved the quality of clothing web-shops. Even with such advancement in technologies, and fast growing market, there are still many hazards proving to be key factors in increasing dissatisfaction among enthusiasts. A few common reasons or problems are; lack of simplicity, lack of depth while developing new prototypes, lack in introducing a prototype which can cover huge market area, and lack of unity and extensibility.

This thesis is projected to purpose a new prototype for a clothing web-shop, which in general will try to resolve the above mentioned problems. In addition to this, it is aimed to develop a virtual supermarket of clothing stores. There are plenty of those web-shops lagging behind because of their online functionality. Although they have quality products they are still behind in generating proper yearly revenues. Such web-shops are either made by moderate designers, or are from those small businesses that cannot afford sky-high expenses of maintaining, and building such web-shops. So, the idea of "DressMe: A web-shop" is to create a common platform for all those struggling and non-struggling businesses to participate in a competitive environment in terms of quality and products. Hence, this will help in bringing equal and fair partnership as well as competition in the market.

In order to meet the demands and expectations of unsatisfied online shoppers, this prototype purposes a unique idea. If the online shoppers have got a functional interactive webcam or supply a face image, a realistic virtual body model will be formed. At the same time, the system compares input data provided by users and clients, and formulates it into the body model. The whole idea is to create opportunities in selecting the best possible outfits for online shoppers.

However, this thesis only focuses on the planning phase, instead of developing DressMe in complete format. The further studies in development of this system will be continued in further studies. The thesis work has been divided mainly in five categories: understanding the proposed hardware, understanding the software design, understanding the whole structure of the web-shop, database management system, and discussion of system's commercial importance.

2 Understanding the Hardware

This section focuses on the hardware requirements as well as challenges faced by recent technologies, and introduces the proposed best model.

2.1 Interactive Webcam

One of the vital components of this proposed system is interactive webcams. These have been proposed in the use of creating realistic 3D model of customers based on technology forwarded by ProForma. This technology has been designed to use an interactive webcam to create a high definition 3D model in a reasonable period of time in the web [3]. In order to have a complete picture about the functionality, it is very important to understand about webcams in general, as well as their behavior with objects at different position.

2.1.1 Introduction to Webcam

A web-camera often termed as webcam is a video camera which feeds its images in real time to a computer or networks of computers, via USB, Ethernet or Wi-Fi. Today, webcams are used in various fields from creating video links, permitting computers to act as videophones to video conferencing. Since, they operate mostly in WWW; they are termed as "Webcam" [4]. They are also used in security surveillance, computer vision, and in the field of Augmented Reality. In spite of all these applications, web cameras have been creating threat in security and privacy related issues, as some of the built-in webcams can be remotely operated via different spywares.

A webcam does not have a complex hardware structure, making flexible and lowest cost form of video telephony. Generally webcams include a lens, an image sensor, and some supporting electronic devices such as in-built microchips. Although various lenses are available, the most common ones are cheap plastic lenses which can be either adjustable or non-adjustable [4]. Since, a camera system's depth of field is greater for smaller imager formats, and thus greater for lenses with a large f-number (small aperture), the systems used in webcams have sufficiently large depth of field that does not impact on image sharpness even with fixed focus lens. Image sensors can be CMOS or CCD, the

former being dominant for low-cost cameras. Most consumer webcams are capable of providing VGA-resolution video at a frame rate of 30 frames per second. However, some multi-megapixel webcams can provide higher resolution, and can perform at higher frame rates taking it up to 120 frames per second. Nowadays, most webcams feature built-in microphones to make video calling and video conferencing more convenient [4]. The UVC specification allows for interconnectivity of webcams to computers even without proprietary drivers installed. The OS such as Microsoft Windows, some Linux versions, Mac OS have UVC drivers built in and do not require extra drivers however drivers are often installed in order to provide additional features [5].

Thus, it is now known that most webcams can help a computer screen to work as a virtual mirror, it is also possible to create realistic 3D model using these highly efficient devices just by focusing an object in front of them. A study related to this behavior has already been made by a student, Qi Pan at University of Cambridge. Mr. Qi Pan has named the project as ProForma. It is a new 3D model acquisition system. It generates a 3D model online by collecting the input sequences obtained by focusing any object in front of a stationary webcam [3].

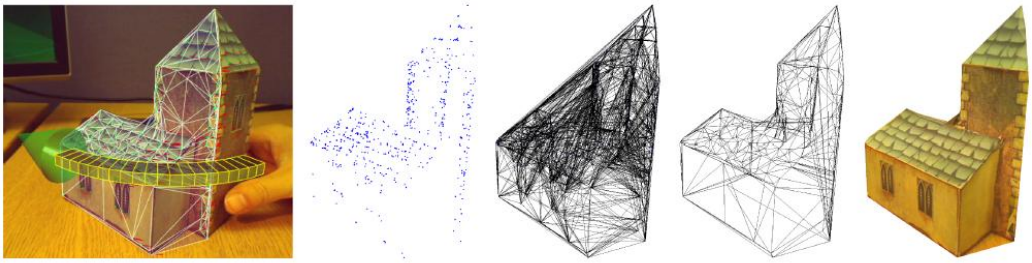

Fig.1. Stages of interactive model reconstruction for a partial model. Left to right: (a) Object augmented with user instructions and mesh model (b) Point cloud from feature tracks and bundle adjustment (c) Delaunay Tetrahedralisation (d) Carved Mesh (e) Textured partial model.[3]

2.1.2 The physics behind adjusting a webcam

A webcam's system is more like a digital vision system. A vision system has to deal with rays rather than points. If we imagine a standard perspective camera, we needed to understand about landmarks. Landmarks are imaginary lines which are the

representative of many rays passing from camera center through a point on the image plane. In order to find the actual position of landmark, it is important to study the behavior of numerous rays passing through numerous camera views at numerous angles, and figure out where they intersect [6].

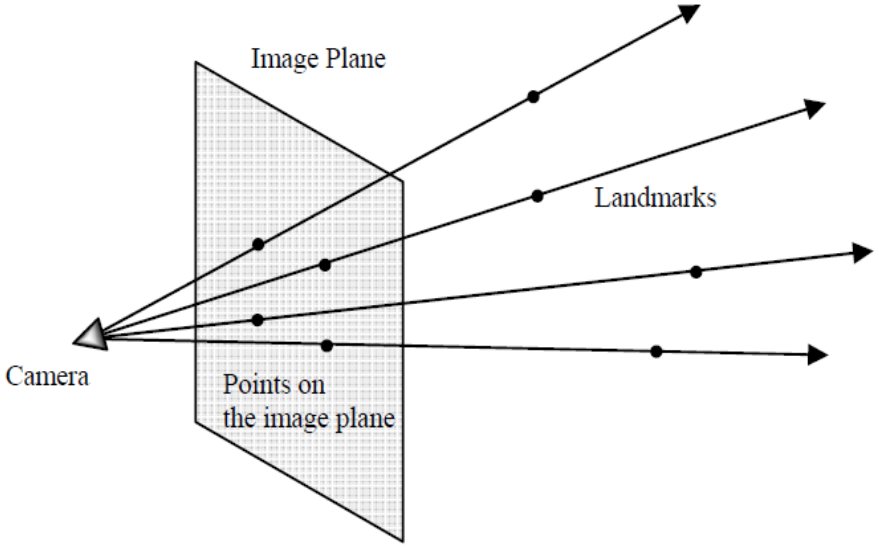

Fig.2. Formation of landmarks. [6]

Similarly, determining the pose from a single landmark is impossible. At minimum, three landmarks are required to compute a unique pose but more landmarks can be used to improve accuracy and combat noise. During the pose estimation process, every landmark rays is given a reliability number. A reliability number 0 indicates the landmark with most reliable feature.

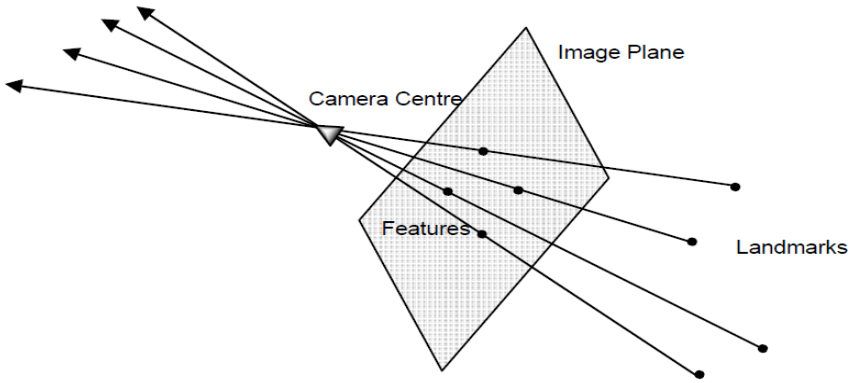

Fig.3. Simple principle in determining pose. [6]

Based on the behavior of reliability of landmarks, a pose can either be consistent or inconsistent. A consistent pose is one in which all the landmarks used intersect at a point agreeing a fixed position of the pose. In inconsistent pose, at least one landmark does not intersect with others. The landmarks disagreeing to intersect are given a higher reliability number, and are removed to establish a consistent pose.

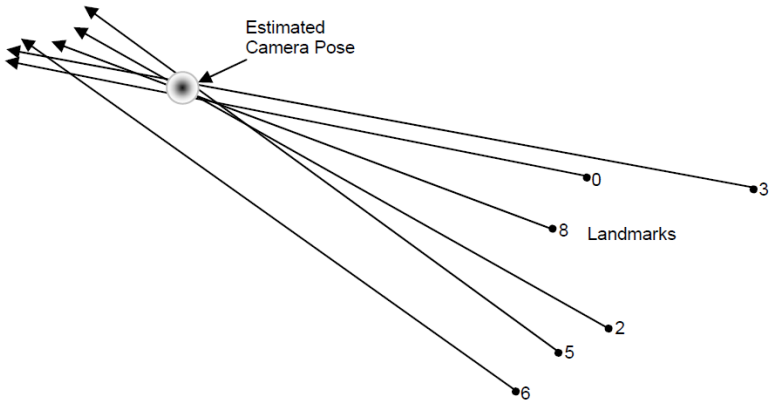

Fig.4. Agreeing and disagreeing landmarks [6]

2.2 Challenges in recently developed technologies

There are plenty of challenges which can be observed from recently developed technologies regarding finding a proper pose or pose adjustment of the object in front of a webcam. It is also believed that finding a natural (100% reliable) pose for an object in a webcam in real-time environment is almost impossible. Further, there will be discussions about the limitations and practical inconvenience of those techniques.

2.2.1 Physical limitation of Current Models

Computer Vision is the field of computer science devoted to extracting some sort of a meaningful description of the world from pictures or sequences of pictures [7]. A classic problem of computer vision has been to continually compute the pose (position & orientation) of a moving camera looking on a scene. This gives challenges in adding virtual game characters into a real life scene [8], or figuring out the position of a robot [9]. The technologies of Computer Vision can be categorized into three different fields:

- Computer Vision and SFM
- Robotics
- Augmented Reality

In the field of Computer Vision & SFM, this problem has been called Camera Pose Estimation (CPE) or Camera Ego Motion (CEM) [9]. The SFM is unable to provide depth of information of certain position. For example, it can provide that a point lies in the landmark but does not provide the information related to its distance from the camera. In the field Robotics, this problem is called Simultaneous Localization and Mapping (SLAM) [9, 10, 11]. When the images obtained are dynamic in real-time environment, it is extremely difficult to estimate a certain point while landmarks intersect simultaneously moving to a different position. This subsequently results in causing errors in estimating a proper pose, and at same time, it creates a greater number of disagreeing landmarks. Similarly, in the field of AR, the problem is known as Registration. AR systems are generally tedious and expensive to set up because the position of the artificial landmarks must be computed accurately [8].

2.2.2 Functional limitation of Current Models

There are different technologies used in trying to create a virtual 3D shop of clothing web-shop. Clothing in general is the phenomenon of look and feel. When going to a clothing store, customers are first attracted to certain outfit by its design, and then customers would like to try it to feel. But, in computer world, the criteria for comparison, at least at first level of analysis, can and should be visual. So, in terms of

Computer Vision, the terms “if it looks right it is right” seem somehow to be a very powerful one [12]. In many clothing web shops, 3D models of clothes, and general 3D models are used in order to see the visual effect of a certain outfit. It has still been impossible to create a proper 3D model of an individual customer, and test every available 3D outfits. However, in recently used technologies by companies like Zugara, webcams are used as a motion capture & facial tracking AR software. These software purpose to use a computer screen as a 3D mirror using a webcam [13].

Although the technology used looks promising, but in practical approach there are many problems concerned. Some of them can be listed below:

- Using a Webcam as a “motion capture device” & “face-tracking device” for virtual shopping creates unnecessary hazards to online shoppers.
- There are problems related to the streaming of such webcam, as most of the time the resolution requirements for such webcam can be tremendously higher.
- Not many customers have an integrated webcam in their computers.
- In order to make proper adjustment in front of a webcam, a customer needs enough space to move which might be difficult if customers are using web shops in a public environment.
- The 3D video images built in real-time using such software are unable to create proper interaction with its customers. This is because the computer screen which acts as a virtual mirror in real-time environment is impossible to provide full resolution, since the screen needs to be two times larger than the object [14].
- If the customers are using a laptop with integrated webcam, it is impossible to adjust them in real-time environment. Since, the human vision towards the image formed on screen is going to be more diagonal than horizontal.
- There are problems not only in determining the proper look for the outfit, but also in determining the proper dimension. Since, in Europe alone, 40% of clothes purchased online are returned with the complaint that they do not fit with their shape and size. Nobody until now has found a solution regarding this matter.

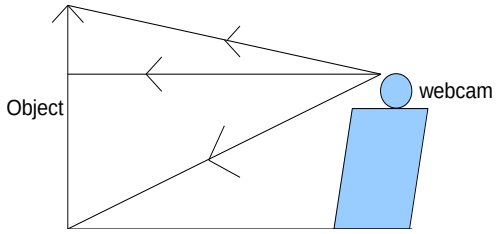

Fig.5. An object focused to the webcam which has diagonal vision instead of horizontal.

2.3 DressMe, the proposed best model

While considering several factors which has been seen as a problem in online shopping specially for clothing web shops, this model has been especially designed to improve those existing problems. The model also purposes a unique idea which gives a possibility of taking online clothing to next level.

2.3.1 Introduction of the model

The model mainly consists of three different phases of online shopping. These phases are shortly described below:

1. Primary Phase:

   The primary phase familiarizes customers with the system, and mainly consists of following parts:

   i) The customer registers information in the system, which can be secured and will be obtained when reclogging in the system.

   ii) Then, the customer can select different web stores available in the virtual super-market of clothes.

   iii) The customer will provide their physical information such as dimension, in order to provide better options for selecting outfits in terms of shape and size.

2. Secondary Phase:

   The secondary phase describes the main procedures in online shopping. In this phase, the inbuilt software designed will perform to give the best possible result to their customer. This phase mainly operates in the following way:

   i) The customer will be asked to select either of two options: (a) select webcam, to create a 3D realistic model of their face; (b) select 2D image converter, to convert a 2D face image to realistic 3D face model [15].
   ii) Customers will have the option to put different emotions in the face by adjusting different points in face model.
   iii) The system already has the in-built "body model" feature of male/female character for different age groups. This model will be integrated with the "face-model" created earlier. The whole 3D model thus created can be adjusted in order to provide better "look" feel by the customers.

3. Final Phase:

   In this section, the customer will be provided with features such as: selection of proper outfits, availability of the outfits in terms of dimension they provide, and billing process. The whole process can be achieved in the following way:

   i) The customers can now select various outfits provided by the system's database. Its special feature will enable customers to have a real-time look feeling allowing them to observe themselves with different outfits with a few clicks on computer screen.
   ii) After a selection of the outfits, an available proper dimension set will be suggested to customers based on their provided information in step 1(i). This will help in minimizing the probabilities of returning chosen outfits.
   iii) Once the customer agrees with the above process, the clothes are then added to the virtual cloth store, which can be purchased later or same time via the available billing procedures.
   iv) The customers information can be stored separately, and every time the customer visits the web shop, he/she will be enable to see his/her history of earlier purchases.

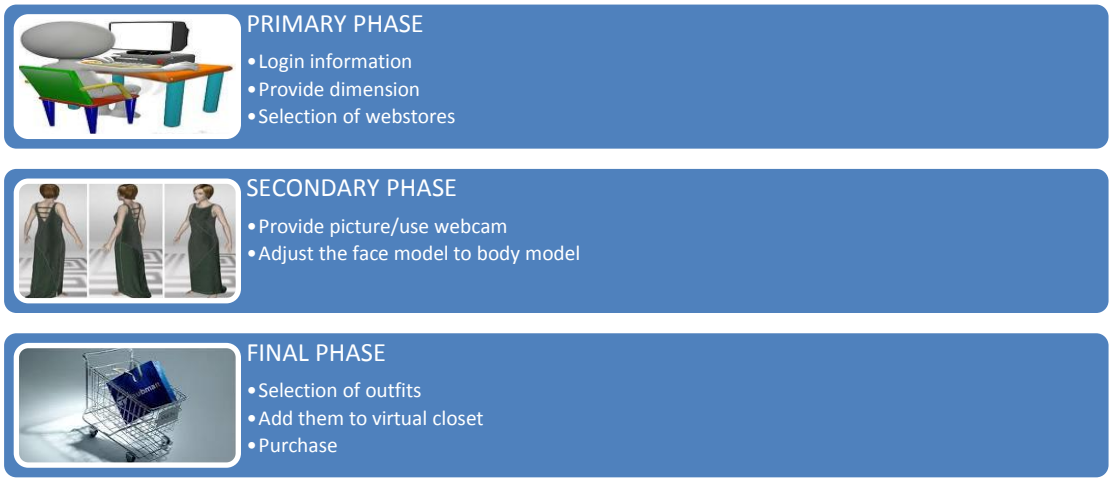

Fig.6. Different phases of virtual supermarket.

2.3.2 Functional Approach

One of the key features of this model can be its functional approach. Based on the studies conducted, three different fields have been categorized to understand the whole functional procedures of the system:

1) Creating a 3D Realistic Image

   As mentioned above, the system uses two different technologies to meet this demand.

   a) 2D Image Converter

      The software is integrated to convert a 2D face image into a 3D face model,

   b) An interactive webcam

      The software (like ProForma) which is integrated in system can create realistic 3D model of the face when focused to interactive webcam.

2) Database Management System

   Since, the system is a virtual supermarket for clothing stores the system contains a huge database. This main database is formed by two other databases which play an important role in data manipulation. These databases can be categorized as following:

a) Customer's Database

The database management comprises of customer related information. Here, the term "customer" is used for online shopper.

b) Client's Database

This can be best described as a "clothing store's database". Here, the information related to available outfits is stored, and which can be retrieved once the customer selects the certain web-store.

3) DressMe web-shop

This is the place where customers and clients operate. The proposed web shop is going to be the virtual supermarket of clothing stores. The main objective of this thesis is to create an environment where customers and clients simultaneously benefit.

a) For Clients

This is the place where clients can update information related to their products, and implement different marketing strategies.

b) For Customers

This is the place where customers can provide their basic information. A separate virtual closet is built where customers can see their selected outfits ready to be purchased, and purchased outfits with all information. After the customers once provide their basic information, the system will save that information. The saved information will be used when customers login to system next time.

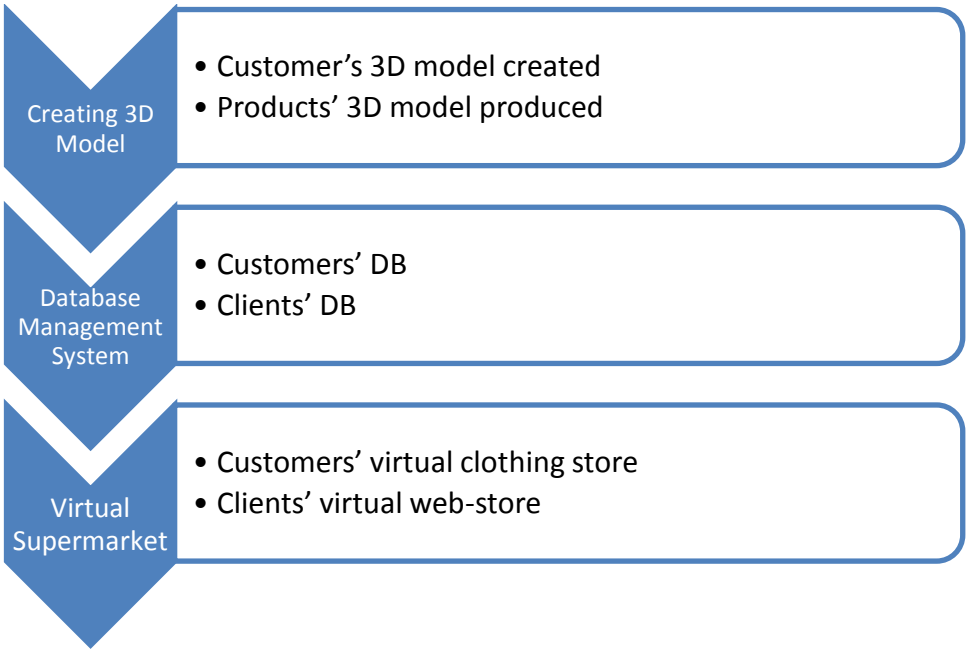

Fig.7. Functional Approach to virtual supermarket

2.3.3 Future Possibilities

There are already many pieces of research which has been carried out to cover needs and expectations of technology-hyped customers. There are more online users than ever in the world, and it has been growing excessively in recent years. At the same time, there is a possibility to acquire already developed technologies, and integrate them into different systems. This proposed web-shop seeks those best technologies in the market.

3 Understanding the Software

The society we are living in is an information society where most people are engaged in sharing, organizing, processing and storing, retrieving and disseminating, or decision making via data and provided information. There are great inventions in computer hardware technologies, but the keys to make this technology also lies in advancement of Software Technology. The software industry has seen the rapid growth in recent years [16].

The development of software goes through different cycles. While talking about common factors of software engineering, we basically remember these two principles [17]:

- Software systems are built by teams rather than individuals
- Software engineering uses engineering principles in the development of these systems that include technical and non-technical aspects.

There have been different approaches proposed in designing software, also called SDLC. However, it has been possible to idealize the following models based on software development process, though the scope of thesis does not permit to describe all those processes [16]:

- The code-and-fix model
- The waterfall model
- The evolutionary model
- The spiral model

Based on the facts and requirements, this project has categorized the following processes in the software development:

- Software Requirements
- Software Design
- Software Implementation
- Software Testing
- Software Maintenance

3.1 Requirements

In all software development processes, understanding the basic needs of software are the primary necessities. These needs deal with the elicitation, analysis, specification, and validation of requirements for software. This is also known as SRS that clearly defines the following [18]:

- External interfaces of the system, which identifies the information flow.
- Functional and nonfunctional requirements of the systems, which stands for finding the run-time environment.

3.1.1 Introduction

The project has been designed to reach the huge mass. Now days, software is not OS-independent. In the same way, there are different browsers with different specifications. The same browser also behaves in a different way when run through different system, for example; computers and smartphones. It is hard to implement the software by developing only one set of it for all systems in the same field of technology. Hence, this software is projected to reach, and meet the following physical needs:

- The software so developed should run in all browsers, hence making it browser friendly.
- The software so developed should run in all Operating Systems in order to reach all online customers.
- The software should be device-friendly.
- The software should be extensible, and maintainable.
- The software should also understand two sets of common requirements [19]:
    i. Enduring requirements: Fixed requirements of the customers.
    ii. Volatile requirements: The changeable requirements during the course of software development.

3.1.2 Specific Description

Based on the degree of importance of each aspect in software development, this project can be well described as follows:

1. Customers' Need (the need of end-users):
   i) The system should be fast, and flexible.
   ii) The customers should be able to retrieve data quickly.
   iii) The delay caused in process while forming 3D model, selecting outfits, storing outfits to virtual closet, billing, and reaching once stored outfits should be reduced.
2. Clients' Need (the need of businesses):
   i) The clients should be able to update their products whenever they want.
   ii) The clients should have space to put additional marketing promotion or advertisements.
   iii) The clients should be able to form 3D model of their products in an easy and more efficient way.
3. Features:
   i) All processes work virtually.
   ii) Customers should be able to select a virtual shop, create a virtual model, and select virtual 3D outfits, receive desirable outfits, store them in virtual closet, and purchase them when they want.
   iii) Clients should be able to make 3D models of their products through specially designed 3D webcams.
   iv) Clients should able to update their virtual shops.
   v) The billing process should be secure and maintained online.
4. Software Specification:
   i) The software should provide functional GUI feature to customers and clients.
   ii) The software should meet the separate functional need of these two groups.
   iii) The software should be able to handle huge data traffic.
   iv) The software should ensure the system's security, and secure sensitively customers' and clients' privacy related information.

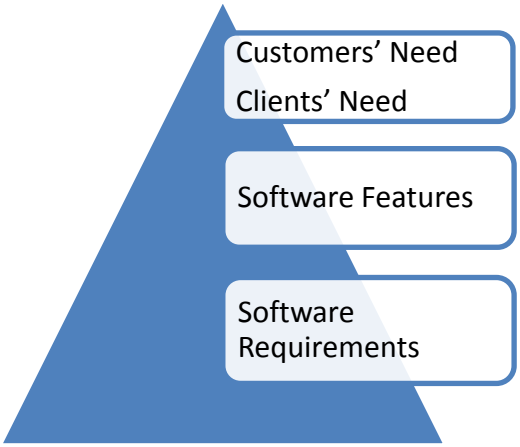

Fig.8. Degree of importance in software development

3.2 Software Design

Software design is one of the most important factors in SDP. After knowing, the requirements of "what" to develop, it deals with "how" to develop software [16]. In general, while brainstorming for designing software, the following three issues/questions come up in the mind of developers:

i) What are the functional, non-functional, and legal goals of designing this software?
ii) What are the most important quality factors and attribute of this software design?
iii) What is the conceptual and technical design background of the software?

Software design also needs an understanding of complete technical details, errors management, and requirements. The technical detail can include software structure, such as, programming codes (also known as the building blocks). Since software design is a huge topic, this thesis is mainly focused only on the conceptual design of software.

3.2.1 Conceptual Design of Software

The conceptual design is more concerned with the "what" part of the software design. While dealing with the conceptual design of the software, the following parts are well defined [20]:

- The source of data
- The transformation to data
- Timing of events
- Output report
- Input screens with options or system functions
- Acceptable user responses and resulting actions
- An outline of the broad system design

Based on the general principle of software engineering, software design procedures have evolved through a series of developments. The principles thus developed provide the basic guidelines in conceptual software design. Some of the principles can be stated as follows [16]:

- Abstraction

  The abstraction part includes the low level information of general software designing concept. It includes the two basic forms:

  i) Architectural software design

  ii) Detailed software design
- Problem re-distribution

  In this section, the complex parts of the problems are solved by dividing them into smaller forms. This works on the principle of *divide-and-conquer*.
- Modularity

  Like problem re-distribution, small modules can be created to represent specific functions. This technique helps while debugging complex programming codes.
- Control hierarchy

  The transformation of modules into higher and lower level has to be interconnected by hierarchical control structure. Basically, the higher modules

work in functional level whereas the lower level modules are used to perform computational work.

- Principle of Information Hiding

  "The principle of Information Hiding, as enunciated by Parnas [33], requires that the modules be defined independently of each other so that they communicate with one another only for that information which is necessary to achieve the software function." The benefits of doing this are:

  i) Developing codes for the modules become easier.
  ii) When the scope gets limited, this process makes testing easier.
  iii) The modules will be independent in structural as well functional manner.

- Principle of Localization

  This principles indicate that all logically related items should be grouped together physically, which can be applied to data and process set.

More additional design features can also be included which deals with these:

i) Principle of Conceptual Integrity: It deals with the uniformity of the design.
ii) Principle of Intellectual Control: It is obtained by recording designs as hierarchies of increasingly detailed abstractions.

3.2.2 Design Consideration

There are several factors which need to be considered while designing this kind of software. In a general approach of software designing, the basic components that need to be considered are listed below [16]:

- Correctness

  This term is normally resolved for architectural and detail design. It also measures the sufficiency of the design to implement the software requirements. The very basic approach could be correctness of "names" or "identifiers" used in UML structure, which are set to design codes.

- Robustness

This feature allows handling miscellaneous and unusual conditions such as bad data, user error, programmer error, and environmental conditions. For example:

i) Instead of aborting a user entering bad account, the program will ask user to try to login back.
ii) It can carry out functions like account verification.
iii) It can provide notification for any error occurred.
iv) In a programming sense, it can check the code whether variables are initialized, parameters are declared, methods well defined, parameters specified, and capture the parameter classes.

- Flexibility

  It is very important in the present context that the software design is volatile. It should update according to the changing environment. For example, the change is essential to handle the volume of transactions, new functionalities, and changing functionalities.

3.3 Software Implementation and Integration

In this phase of software design, the concepts and goals are translated into tangible action; because of that it is one of the most difficult phases of the project design. In software engineering, system integration refers to bringing all subsystems' components and ensuring that they function together. The technique of system integration also brings together discrete subsystems through computer networking, enterprise application integration, business process management or manual programming. The process of system integration can be referred as "glue" between system, and subsystems. There are numerous issues to address while dealing with system integration, such as platform, understanding the techniques or design process, as well as understanding the volatile and non-volatile change in system design. [21]

In this project, a theoretical background on software integration processes, and what the benefits a system designer achieves are briefly explained.

3.3.1 Process of Software Integration

Some important methods of software integration are listed below [22]:

- Vertical Integration:

  It is the process of integrating subsystems according to their functionality by creating functional entitles referred as *silos*. This method is much cheaper, but on the other hand, the cost-of-ownership can be substantially higher than seen in other methods. The reason behind this is that in case of new or enhanced functionality, the only possible way to implement would be implementing other *silo*.
- Star Integration/Spaghetti Integration:

  In this process of system integration, all subsystems in the software design are interconnected and linked with other system components.
- Horizontal Integration:

  In this process, a specialized subsystem is set to communicate between other subsystems, hence allowing cutting number connections (interfaces) to only one per subsystem which will connect directly to ESB.

3.3.2 Importance of System Integration

Some reasons for system integration are listed below:

- System Integration makes software development cheap.
- It helps in bug determining, correcting, and updating entire modules.
- It helps to bring more pace to the software development.
- It helps in giving a clearer picture in software development.

3.4 Software Testing

Software testing is the process of finding errors which occur during the process of software development. The errors can occur anywhere at any time during all phases of software development, and testing is carried in order to check or control such errors.

According to Myers (1979), testing is the "process of executing a program with the intent of finding errors." In the same way, according to Hetzel (1988), testing is the "process of establishing confidence that a program or system does what it is supposed to do." [16]

The software defects can mainly be three types, (i) the defects in software code, (ii) defects in supporting manual, and (iii) the documentation. The aspects which mainly cause software defects can be:

i) Wrong Code/Information:
They can occur while coding, or during wrong implementation of product specification, etc.

ii) Extra code/Information:
The additional information, or extra information are added which does not belong to the category of software development procedure.

iii) Missing code information:
Absence of designated code or specification feature of a requirement; which can be identified by customers/developers during the development phase.

3.4.1 Test based on performance

In testing lifecycle, it is very important to implement various strategies, and develop a test plan. These methods work simultaneously with software development process. In general, specific tactics can be categorized into four types conducted within two groups.

Group I:	1. Verification	2. Validation
Group II:	3. Functional Testing	4. Structural Testing
	(Black-Box Testing)	(White-Box Testing)

The main goal of verification and validation are quality assurance. This can be approached by following these procedures [23]:

Verification:	Are we building the product right?
Validation:	Are we building the right product?

The quality assurance by validation and verification can be achieved by [24]:

- Conscious search for defects

- Feedback to software engineers for rework and correction of defects.
- Feedback to management for fixing baselines.
- Providing visibility to design and code
- Providing confidence to the management regarding the quality and the program of the software.

Functional testing also referred to as Black-box testing, does not deal with the entire structure of the source code. A functional tester is not expected to have knowledge of interior of software. In the black-box testing method, the tester inputs the test agents, and expects to receive the outputs according to it. Therefore, in this testing method, the tester has advantage of an "unaffiliated opinion", on the other hand, he/she has the disadvantage of "blind exploring" [16].

In structural testing, also known as the White-Box testing method, the tester has access to internal of software including algorithms and codes. White-Box testing can be conducted in two phases; (i) by strategically analyzing the tests risks in different sector, and (ii) by conducting a test plan based on those risks.

Based on the software architecture, and performance, White-Box testing can be conducted in the following ways:

- API testing
- Code Coverage
- Fault injection: This is a method which includes injecting fault codes, and studying the behavior of the application
- Mutation testing
- Static testing

3.4.2. Security Handling

In this project security issues are amongst the most sensitive part of software development. The reason behind this is that software will handle large quantity of customers' and clients' personal information. Several issues can be drawn, and when these issues are not handled, it can even hinder in the process of software development.

Thus a regular test-plan should be conducted in order to mitigate such unfortunate circumstances.

3.5 Software Maintenance

Even after having a test plan, and undergoing several test; software is still vulnerable to errors. Hence, the software maintenance is essential. This deals with the post-delivery activities and involves modification of code and the associated documents in order to eliminate the effect of residual errors that come to surface during its implementation.

The IEEE standard 1219.1998 identifies seven maintenance phases, each associated with input, process, output, and control [16].

- Problem/modification identification, classification, and prioritization
- Analysis
- Design
- Implementation
- Regression/system testing
- Acceptance testing
- Delivery

4 Database Management System

Before going through the detailed structure of database management system, few background studies have been reviewed to better understand this project. It is also very important to understand how this technology evolved. It has been known that there are numerous unmanaged "data" around us which needs to be administered or in other words needs to be managed. So, a preliminary step was to understand what those "data" really are in computer terms. Data are basically raw or isolated information or facts from which the required information is produced. While looking at the space where data would be utilized, stored, updated, or processed; it could be computer software. For data, computer software represents an organization where they exist as an identity. Thus, they are organized in three basic layers of structure [25]:

- Operational data

  They can be stored in multiple operating systems throughout various organization systems.
- Reconciled data

  They are stored in organization warehouse and operational data store. They represent the main authorized source for all decisions to support application.
- Derived Data

  They can be stored in different format. They could be selected, formatted and aggregated for end-user decision support application.

A Database Management System, often termed as DBMS generally is a software package that controls the creation, maintenance, and the use of a database. It can be classified on the basis of number of users and the database site locations [25].

1. On the basis of number of users:
   a. Single-user DBMS
   b. Multi-user DBMS
2. On the basis of site location:
   a. Centralized DBMS
   b. Parallel DBMS
   c. Distributed DBMS
   d. Client/Server DBMS

DA and DBA generally manage issues related to data, and database management, and DBMS. However, they have different role in database design and organization [26].

- The role of DA includes:
  i) The operation and maintenance of database
  ii) The type and details of the data to be contained in the file system.
  iii) The files availability for types of processing.
  iv) Maintaining the security and privacy of the file.
  v) Setting the authorization levels to determine who is allowed to access and the types of data.
- The role of DBA includes:
  i) Database design
  ii) User training
  iii) Database security and integrity
  iv) Database system performance

4.1 Database types and management

Based on the software design and requirements of this proposed system, DBMS comprises mainly three databases; a secondary database, a primary database and a main database.

4.1.1 Secondary Database & management

The project affiliated with DressMe has been designed in order to store primary information related to registration, customer's dimension, and products' details. The database management technique which has been used in this mode is based on Client-Server architecture. In this structure, the secondary database is connected to the server which uses DBMS for data definition, security handling, data manipulation and data integrity. The servers are connected to the clients at front ends, and application provided by clients is used by its end users.

The secondary database is thus distributed into other three categories which are discussed below.

4.1.1.1 Registration Database

A separate client-server architecture can be applied to manage the registration database system. The registration database has been implemented to perform the following tasks:

- Customer's login information is stored in this database.
- Client's login information is stored in this database.
- Using DBMS, customers and clients are able to manipulate the data registered.

In this database design architecture, clients and servers run on different machines. The clients are able to feed information from any machines. Although, this sounds difficult, the DBMS application is designed to facilitate connecting them. The client's and customer's application regarding registration can be different, but both of them have been made available by the software vendor.

4.1.1.2 Customer's Dimension Database

This database has also been designed to use Client-Server architecture. Here, the customers' data related to their body dimensions are stored. The reason for establishing a separate database in order to store these data is to facilitate in obtaining, and applying those data. Otherwise, it might create a huge traffic when one database is used, resulting in slowing down the system. The data related to customers' dimensions are collected via the GUI used by the software.

4.1.1.3 Database of Products

The clients are also provided with a separate warehouse where they can store data related to their products. At the same time, clients also provide the general information related to dimension of each product. These data are very useful because the customer's provided information related to dimensions are compared with data provided by clients in order to provide the best corresponding data and information to customers. Hence, each of these databases is interconnected.

4.1.2 Primary Database & management

The primary DBMS is designed to link the secondary database with the main database management system. It plays an important role in connecting and managing those huge data warehouses. The primary database can further be distributed into two other databases.

4.1.2.1 Customers Database:

This interconnects two databases from the Secondary DBMS. They are: the Registration Database and the Customer's dimension Database. The customer database links the customer's data to the main DBMS.

4.1.2.2 Clients Database:

This interconnects two databases from the Secondary DBMS. They are: the Registration and the Database of Products. The client's database links the client's data to main DBMS.

4.1.3 Main Database

The centralized database system by distributing and creating subsystems is designed in order to create better functionality of DBMS. The main database controls, and manages all the database systems.

The figure below shows the relationship between each database management systems.

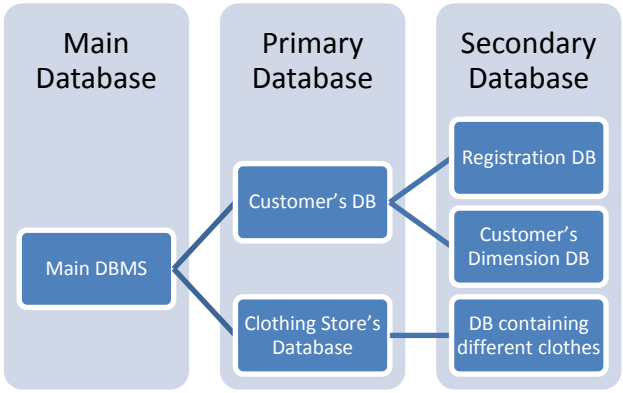

Fig.9. Database connection and distribution.

4.2 Maintaining DBMS

The tasks of maintaining a DBMS is carried out by different personnel during application development. In this system, maintaining of DBMS maintenance focuses mainly on following tasks:

- Obtaining and managing customer' information
- Obtaining and managing client' information
- Handling a software application that links customers and clients over the Internet or computer networks
- Coordinating and monitoring the entire DBMS, its performance and efficiency.
- Handling the customer' and client' data security issues.

In the process of maintaining these huge databases, it is important to understand the primary objectives of DBMS design, as well as the extensibility and compatibility of software used. This is shortly explained below.

4.2.1 Primary Objectives of DBMS

The larger systems are, the more vulnerable they are to Internet hackers. There are studies demonstrating that a large amount of data and information over the Internet are either being theft or exploited [32]. Hence, the security of that information has always been a primary concern while designing any system that works over the Internet. It is always required to have strategic planning, implementing them during and after the development process. However, the major concern of DBMS has been the following:

- Data Modeling:
  This is the model which describes the data in an organization (Here, the organization term can be used for the DBMS software.). It can also provide a framework for abstracting and documenting. Hence, a proper data modeling is required.
- Database Planning:
  This is a strategic effort to determine the needs while creating databases. A proper database plan has to be implemented and is required to be understood by

the entire team working on the development of the software. This is one of the key approaches in identifying and minimizing attacks before and after the implementation of software application.

- Managing Security

  The system is designed to use a virtual warehouse where one can keep safe all their assets. Hence, securing a warehouse is always the most sensitive part of DBMS. Since hundreds of clients and thousands of customers create their own sets of database in order to store their personal information, it is necessary to provide assurance that the system is eligible to keep that information safe. Generally, the individual authorization system is applicable in all sort of service-oriented or customer-oriented systems. The three basic ways of tackling security issues are [26]:

  i) Authentication
  ii) Authorization
  iii) Encryption

4.2.2 Extensibility & Compatibility

Usually, the databases are designed to be compatible. This project also emphasizes on the scalability and compatibility and compatibleness of the system. This generally means that the software can run in any environment, is expandable, and is convenient to use. The software should understand all database programming languages, should run in all browsers, and should work efficiently.

In this project, the database so designed should be expandable. That means there will be room for many clients to join the virtual supermarket, possibility to create their own virtual dressing warehouse, and ready to compete in the market with other online web-shops. At the same time, there should be the room for new customers to add information, and create their own virtual dressing room.

5 Functional Approach of Web shop

In this topic, the layout of the software or web shop will be discussed in more detail. This will also include how a unique modern approach is thought to implement converting a web-shop into a virtual supermarket.

5.1 Physical structure of Web shop

This proposed web shop is thought to serve an unlimited amount of clients and customers just by using a single platform. Some of the features of this web shop are going to be:

- Customer-based user interface
- Client-based user interface
- Possibility of creating a real virtual world of clothing
- Easy ways of making 3D Avatars of customers
- Easy ways of making 3D models of clothes
- Easy access to information sent by clients about their products
- Giving the real visual effect, while customer tries and selects available clothes from the clients' warehouse.
- Providing real vision in the process of finding out the best possible outfits to their customers.
- Ease in adding selected clothes to a virtual warehouse of customer selecting them when needed and purchasing them from the same system.

5.1.1 Contents & Planning

The online clothing web shops which are seen in the market are not uniform in terms of the service they provide, the technology they use, and software functionality. As a result, it has created a slight confusion among potential online shoppers. The aim of this project is to plan such a web shop, which will unify all shortages and lacking of real feel that could be generated in a virtual world.

The contents of the web-shop will cover the following main topics:

1) Home page introducing how the system works.
2) Logging in facilities to customers and clients
3) Possibilities to see and put advertisements.
4) Location tracking system to find the nearest physical store.
5) List of clothing stores for making a selection.

An outline of this content planning can be seen in the figure below.

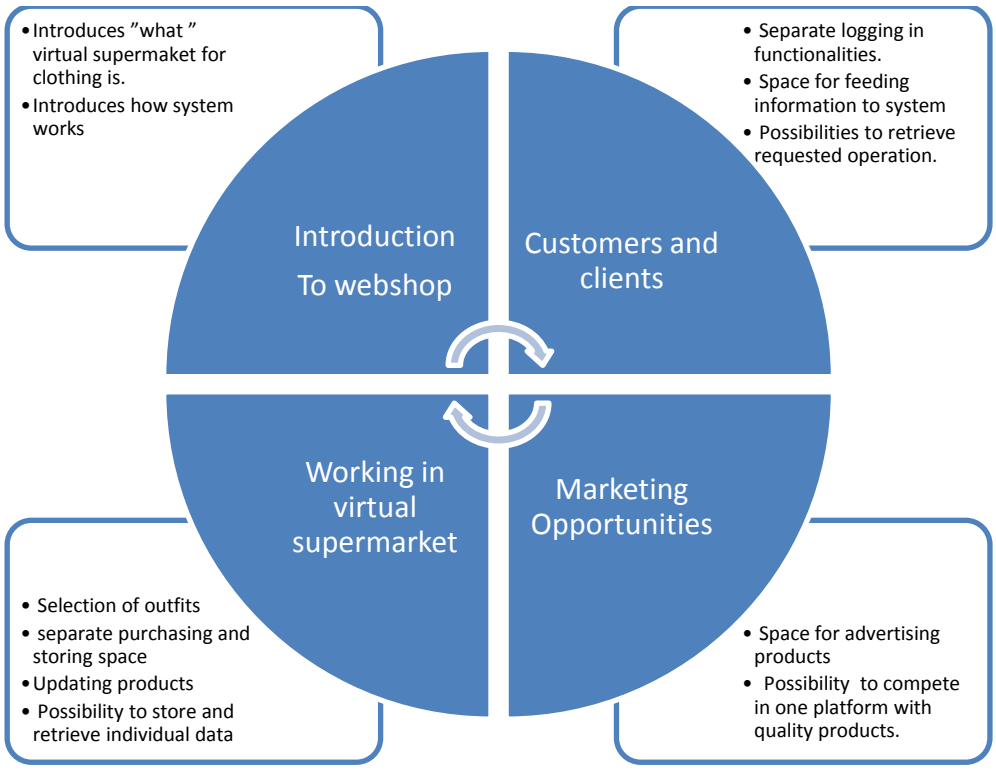

Fig.10. Content planning for virtual web-shop

5.1.2 Customer's approach to web shop

There are different new functionalities which have been thought to create a real feeling of cloth shopping in the virtual world. The system enables customers to create their own 3D Avatar or model which can be used by them to select various outfits provided by the web shop they choose to shop.

The steps how a customer approaches to web-shop can are summarized below:

- Customers can login his/her account in the web-shop
- Customers create a 3D Avatar (model) himself/herself, using the following technology provided by the web-shop.
  - (1) 2D image converter; which converts a 2D face image provided by the customers to a 3D image. This can be modeled with the body model already present in the system.
  - (2) Or, a 3D webcam, with a good resolution can be used to create 3D realistic Avatar using software available in the web-shop.
- Customers adjust their body using adjustment functionalities already provided in the software. The adjustment functionalities will ask customers to put their dimension information in the system. The model appears in the screen according to the information provided.
- Customers can then appear to different web shops available in the market, select various outfits from them, and add them in their virtual warehouse also called virtual closet.
- Customers can have option to save their searches, and buy the selected products when they need, any time they login into the system.
- Once the information, such as body dimension, 3D Avatar, and virtual closet, is provided, it can all be retrieved when they login back into the system.

Fig.11. The customer approach to web-shop

5.1.3 Client's approach to web shop

The clients running web-shops are always keen to create more market for their products. The clients' presence in the web shop is thought to be as important as customers' satisfaction. In order to create balance between the customer needs, and provide clients' opportunities to meet their customer' demand, some steps have been considered.

The steps how Clients approach this under-designed web-shop are summarized as:

- The clients will also have a login facility
- The clients will be able to update their virtual warehouse any time they login.
- When the clients need to introduce new products from the physical warehouse, they can create a 3D model with the help of a 3D high resolution webcam, and application provided in the web-shop.
- The clients will have possibility to put promotion, and advertising banners in the web shop.
- The clients will be provided with options to track their sales.

Fig.12. Clients' approach to web-shop

5.2 Web shop maintenance

A centralized data management system has been preferred in order to manage different web-shops present over the Internet, web contents and media objects which are directly linked to customers, products, and clients. A special Product Information Management (PIM) system has been applied to deliver a wide array of products with quality assurance. There will be plenty of sectors which are needed to be considered while thinking of making a well-maintained virtual supermarket.

It has been well known that a well-functioning physical supermarket needs active workers in order to meet customers' demand quickly. The same way, a virtual supermarket also needs well-functioning and quick-responding applications. These applications will be developed or used by several technicians of different fields. Some of the technicians required while maintaining these kinds of huge web-shop include:

- Data Administrator for manipulating data, to create a proper database.
- Database Administrator, who is responsible for handling the DBMS.
- System Tester, who is responsible to make strategy, planning, and implementing different necessary software-testing techniques, could often do their tasks before, or after the development process.
- System security analyzer, who is responsible for handling all security vulnerability issues,
- Project Administration, the unit which is responsible in taking part from the beginning of system development to its implementation.

6 Commercial Approaches

The proposed web-shop has everything to be a commercial success. The software is designed to meet the technical and other difficulties in the field of online clothing business. While talking about best fittings, every human being has its own characteristic way - to look and feel for different outfits. In online clothing web-shop, it has always been difficult to create such 3D models where a customer could see himself/herself wearing certain clothes. Instead, a customer has to depend on male/female model characters available in the web-shop.

After closely studying few well known web-shops in the market, this project could face the following major limitations which could hinder the future of online clothing business:

- It is always difficult to compare one-self with such male/female models available in the web-shops. Those models do not give any look feeling to their customers.
- The outfits described usually do not mention proper dimensions. For example, a European size could be different from its American size. For some customers, it is also difficult to determine which number would better fit them.
- Many web-shops completely miss a virtual closet or warehouse for their customers.
- Some web-shops that use AR technology for creating a computer screen as a virtual mirror and use motion capture sensors, still have problems with webcam adjustment.
- Although customers interact with a web shop more virtually, a physical approach, or environment has not been considered well while designing those web-shops.

The proposed web-shop deals all those above problems, and has a specific way of tackling them which has already been explained in previous chapters.

6.1 Virtual Supermarket

The reason why most of the shops inside supermarkets are more successful than those operating alone is mainly because of the huge amount of customer flow in them. Therefore, to sell more products, any business needs a specific amount of customers to buy them. In this modern age, customers are as intelligent as those retail shops. There are also new concepts and strategies evolved recently and are growing which offers better options and possibilities for the customers. The customers are better attracted to that location where they can find all those items. At the same time they have the possibility to compare the quality and price of the products. Hence, the business owners are, therefore always looking for larger scope to take their products. The big markets are always the first requirement of any product selling businesses.

While virtually seeing those aspects, it is difficult to see if there are such virtual supermarkets where there are many web-shops with fair competition. Hence, this research sees the need of developing such a system which could bring unity among diversity. Some reasons why this could be a powerful option for economic growth are:

- Not all web-shops can maintain quality and technology equally as others in the market. Hence, they always fail to compete with large companies with more spending power.
- Due to lack of advertisements and promotion, customers tend to purchase lower quality products from large companies than companies with less spending power.
- The recent tendency and market practices always favors large spending companies, which could exploit market more easily than which strive to find their existence [27].
- Hence, a virtual supermarket will be a platform for those entire groups where they can use the technology equally as others, and practice their business like others. Thus, creating more chances and hopes for those who always struggle to survive.

6.1.1 Exploring different web-shops

There are very few virtual web-shops that work as a virtual supermarket on the Internet. The customers' tendency while looking for clothes costumes via Internet is to find the best possible outfits, quality products, and reasonable pricing. The author's proposed work enhances customers' presence and online practices in seeking quality products via the Internet.

The facility of exploring different web-shops in the virtual supermarket helps customers in following ways:

- Selecting the best outfits they want, and comparing them with each other.
- Comparing prices, and quality of the products.
- Getting to know the latest updates.

6.1.2 Creating a Competitive Environment

The author has emphasized that the virtual supermarket is not designed only to help customers, but also to help the clients' businesses. Since, both successful and unsuccessful businesses can compete using this platform, it creates a fair competitive environment in the online business market.

The main reasons why author thinks that it brings the best possible opportunities for both sorts of businesses are:

- The companies which have web-shops functionally and technically do not meet the requirements of present market have the possibilities to enjoy and practice solid technology used in this proposed virtual supermarket.
- The companies which have strong presence with technology and quality they offer through their web shops but are unable to reach in different levels of customers have the possibility to flourish their market.
- Both types of companies can use the same technology, and also use it to promote, and market their products at different levels of virtual supermarket.

6.1.3 Possibility to attract huge mass

DressMe is definitely designed in order to reach huge mass because it carries their needs. The author's proposed model has tried to solve most of the issues related to online business of clothing stores. The issues listed range from technical difficulties for customers in using web-shops to its simplicity in application. It also provides a huge amount of functional applications.

- A virtual supermarket is designed to fulfill the demands of customers/clients.
- It introduces unique, feasible, and comprehensive technology

Fig.13. DressMe for clothing web-shops

6.2 Challenges

While discussing the trend of companies participating in e-commerce, these companies can be categorized in two different classes [28].

- Pure-Click companies: are those companies which have launched their website without previously having any firm in existence. For these companies, the customers' service is of paramount importance.
- Brick and Click companies: are those companies that have added an online site for e-commerce. These companies were skeptical whether or not to add an online e-commerce since this might conflict with their physical off-line retailers.

Hence, the challenges of running a virtual supermarket of those web-shops are extremely high. However, those challenges can be nullified by creating a tremendous flow of customers to their web-shops.

Thus, the challenges lie on techniques of perceiving those efforts in building big online markets. There have been ups and downs, positive and negative feedbacks concerning the huge implications of e-commerce. Some of them can be listed below:

- Many economists believe that e-commerce has intensified price competition. When web-shops start making good sales, fixed costs of the products and production are relatively low to those physically existing retail shops.
- The use of e-commerce has affected the industry structure of many businesses.
- E-commerce has helped customers to gather more information about products and prices over the Internet.
- Many economists believe that the use of e-commerce has helped only larger firms, and they grow at the expense of small retailer shops.
- However, many believe that implication of e-commerce has helped to reach the wider scope, and different level of customers.

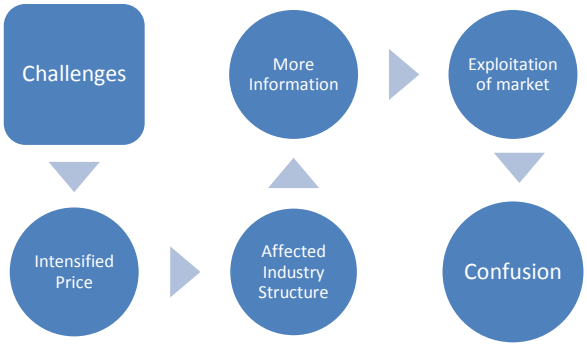

Fig.14. Challenges and effects of e-commerce

6.2.1 Competitors

The author has identified a few possible competitors. However, none of the competitors are engaged directly in the development of virtual web-shop. On the other hand, these competitors' work can even be implemented during development process of this project.

The lists of companies or development projects which are involved in this possible field are:

- My Virtual Model:
  Creates a virtual model of customer where a customer has to supply his/her picture. Customers are also allowed to adjust their body dimension. This is a really handy feature; however this feature can also be used in the virtual supermarket [29].
- Zugara's AR technology for creating a digital dressing room [13]
  Zugara, one of the prominent AR model developing companies in the online market, has also gone forward in trying out AR technology to create virtual dressing room. They have used some technologies, which could have future possibilities, such as;
    i. Motion capture technology
    ii. Facial Tracking technology
- Mywardrobellc.com
- The Fashionista Virtual Dressing Room

6.2.2 Risk Analysis

The technique to identify and access factors that may jeopardize the success of project or achieving goal can be termed as Risk Analysis [30]. One of the popular methods performed for risk analysis in software field is called FRAP. It analyzes one system, application or segment of business processes at time.

In this project, author has tried two main steps in ongoing risk analysis process.

- Risk Identification

  Based on the project, the following risks have been identified:

  i) Integration of two technologies (converting 2D face image to 3D, and creating 3D model via webcam) in the web-shop could be challenging.

  ii) Managing a huge database of web shops, creating a separate environment for them to operate individually can be technically challenging.

  iii) The development process can be lengthy since in this project the author has signaled that a distributed step-wise system testing should be performed.

  iv) There is always a risk in handling individual data, while operating a system on the Internet. The Internet is an open space where there are many security hazards. Immediate steps are needed whenever there is attack on the web shop, in order to protect those huge data.

- Risk Management:

  Some of the risk management technique that has been proposed are [31]:

  i) Avoidance

  Not involving the process if the procedures seem unlikely to be developed, or are more prone to internal and external attack.

  ii) Reduction

  Optimizing or mitigating unnecessary description, or codes.

  iii) Sharing

  Transferring or outsourcing data immediately once it is found vulnerable to attack.

  iv) Retention

  Immediately accepting the threat, and supplying all measures to eradicate the issues.

  v) Re-evaluation

  Whenever certain demands meet during the SDP, a team to re-evaluate work should be formed in order to evaluate the advantages and disadvantages of the accomplished task.

6.3 Future of Next-Generation Virtual Clothing

The practice of taking big shopping centers online has already been started since 1996, when Amazon.com and eBay started their business. Since, then the Internet and e-commerce development started speeding up. This resulted in many shopping centers going online. For example, the owners of shopping centers have attempted to put in place a strategic response to e-commerce that would enable retailers within the center to enjoy the benefits of both conventional and online shopping opportunities. For many years, the use of marketing across all forms of media has been an important and growing aspect of shopping center management over recent years. The Internet and e-commerce are the most recent and active types of such activity.

Although there has been a lot of negative feedback from consumers about online clothing, but one thing is sure that it is considered by many the future of clothing market. Hence, the need of a realistic and simpler virtual dressing room has heightened recently. There has been many inventions going on, and new technological advancement has been focused onto it. The virtual clothing stores have attracted variety of customers. Those potential online customers can be categorized as follows:

- Customers who feel comfortable to try out different outfits staying home but do not intend to buy them immediately. Therefore, they do not have to buy it if they do not like it. When these customers are in physical retail shops, they feel uncomfortable to try out different outfits.
- Customers who lack the time to go out and shopping. They do not have enough time to go to retail shops, select different outfits, try them out, and finally purchase. Such customers would prefer to do them anytime anywhere using their computer with a few clicks.
- The potential customers who are very skeptical about the feasibility and efficiency of virtual clothing. Such customers have never bought anything online, but are always following the new events cautiously.

The future possibilities of this the proposed virtual clothing supermarket can be further discussed in the following subsections.

6.3.1 Future Possibilities

The future possibilities and scope of this proposed project can be stated below:

- Creating a big mass

  It will attract a big mass of consumers. This proposed project has everything it needs to be a perfect virtual super market for clothing. It is so much customer-centric as well as client-centric. This means that it helps customers in finding out solution for their shopping dilemma, and for clients, many new customers.
- Creating a fair competitive culture

  It will bring together small and medium-sized as well as big firms, and practice in fair competition. Since, the technology available for all are equal and same, the competition will be based on the quality of products they provide, and the promotion they create to attract new customers.
- Creating a common platform

  A virtual web-shop will have many different web-shops from retailers under it. They all get a common and equal platform while regulating their sales and marketing.
- Promoting Quality

  The costumers will have the chance to compare different products, try them out virtually with a real feel, and compare prices from different shops. This exposure to customers means that it will encourage retailers to put value on quality products.
- Reducing expenses of retailers

  It is not necessary for retailers to think about marketing their individual web shops, once they are inside the channel of this virtual supermarket. When the virtual supermarket is published, promoted, marketed, and has put all efforts in reaching every customer's computer screen, it is for certain that the retailers having web shops in the virtual supermarket will get noticed. Such facilities will help retailers to save resources in maintaining, and marketing their web shops. Hence, retailers tend to benefit from every angle with this project.

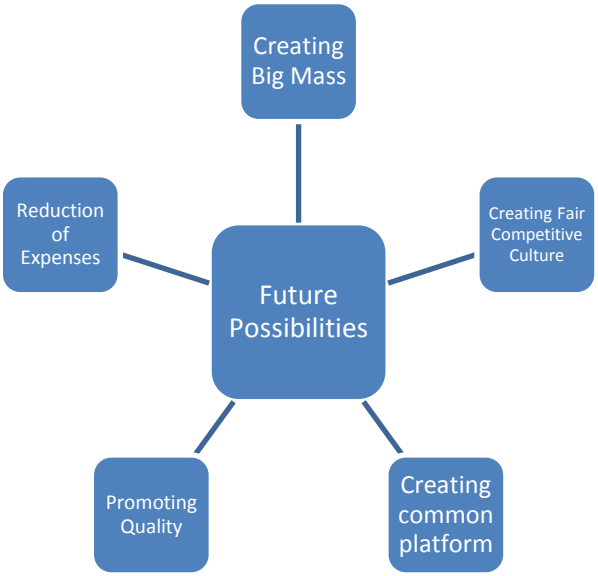

Fig.15. Future Possibilities of Virtual Supermarket

6.3.2 Global Extensibility

One of major advantage of virtual supermarket is that it runs on the Internet. The Internet is such a platform which does not require a lot of physical preparation to take it to global market. For instance, large shopping centers like IKEA, LIDL, PRISMA, etc. spent millions of euros to move from one place to another. They need to think about the premises, location, and a lot physical preparation to establish a physical supermarket. But, the Internet world, those preparations are not necessary. One can establish a virtual super market of such kinds at fairly low price. Saving such initial costs is so much crucial for any businesses. Hence, the virtual supermarket having this kind of caliber is naturally prone to reach in global market.

7 Summary

The Internet is most demanding, and fast-growing marketing platform. It provides possibilities of creating huge networks, and, at the same time reaching different levels of customers. Since, different business practices have gone online; the clothing business has been affected as well. Although it has been a decade since clothing stores went online, there is still a need for creating more customer-centric, simple, and effective web-store.

"DressMe Webshop" is a creation to meet demands at present, and holds future possibilities in online clothing business. The author has proposed this system to be simpler, and more functional. The online shoppers have always been confused about purchasing clothes online, since there is no feel for looks and fitting in existing online shopping stores. However, several inventions have been made in finding more realistic features for virtual clothing. The development of AR technology, webcams and different 3D modeling technologies has created opportunities in trying to discover the best possible models.

This thesis is a conceptual analysis of a prototype for creating a virtual supermarket. In order to establish a better understanding of this concept, the studies have been made under different topics. The hardware systems deal with problems which arise because of improper pose, and difficulties in creating a proper pose from existing technology. The software part has described the basic software development process, and possibilities in utilizing available technologies in effective way. Similarly, studies have been made to understand in creating and controlling databases for clients and customers. A functional approach to a virtual supermarket has been proposed to give overall approach to the web-shop. Finally, the author has included the commercial approach for this proposed web-shop.

Hence, a unique idea which can possibly be a next generation for clothing shopping industries has been proposed for the betterment in the development of virtual clothing practices.

References

[1] Internet World Stats, updated 31 March 2011. [www-document] Available at: [Consulted: 05.12.2011]

[2] Chaudhury, A.; Kuilboer, J. (2002). *E-Business and e-Commerce Infrastructure.* Boston: McGraw-Hill.

[3] ProFORMA: Probabilistic Feature-based On-line Rapid Model Acquisition. [www-document] Available at: [Consulted: 29.11.2011]

[4] Negash, S.; Whitman, M.E.; Woszczynski, A.B.; Hoganson, K.; Mattord, H. (2008). *Handbook of Distance Learning for Real-Time and Asynchronous Information Technology*. USA: Education, Idea Group Inc. (IGI)

[5] USB Camera with integrated UVC+UAC and Autofocus CMOS OV3640. [www-document] Available at: [Consulted: 01.12.2011]

[6] Zhang, X. (2005). *A method for determining the pose of a handheld webcam.* The Australian National University Canberra: Proc. of the Australian Undergraduate Students'.

[7] Forsyth, D.; Ponce, J. (2002). *Computer Vision, A modern approach*. New Jersey: Prentice Hall.

[8] Thomas, B.; Close, B.; Donoghue, J.; Squires, J.; De Bondi, P.; Morris, M.; Piekarski, W. (Oct. 2000). *ARQuake: An Outdoor/Indoor Augmented Reality First Person Application. 4th Edition*. Atlanta: International Symposium on Wearable Computers.

[9] Garcia, M.; Solanas, A. (2004). *3D Simultaneous Localization and Modeling from Stereo Vision*. New Orleans: IEEE International Conference on Robotics & Automation.

[10] Davison, A.; Kita, N. (2001). *3D Simultaneous Localization and Map-Building Using Active Vision for a Robot Moving on Undulating Terrain*. Kauai: Proc. of IEEE Conference on Computer Vision and Pattern Recognition.

[11] Davison, A.; Gonzales, Y.; Kita, N. (2004). *Real-Time 3D SLAM with Wide-Angle Vision*. COEX, South Korea: Proc. IFAC Symposium on Intelligent Autonomous Vehicles.

[12] David, H.; Breen, D. (07/2000). *Cloth Modeling and Animation: A Small Business View: A K Peters*. MA, USA: Limited Natick.

[13] AR software. [www-document] Available at: http://www.zugara.com/ [Consulted: 23.11.2011]

[14] Images formed by mirrors. [www-document] Available at:

[Consulted: 25.11.2011]

[15] Zhuang, H.;Theerawong, T.; Guan, X.; Morgera, S.; Pandey, A. (2006). *A Method for Creating 3D Face from 2D Face Image*. Florida Atlantic University Boca Raton, FL 33431: Florida Conference on Recent Advances in Robotics (FCRAR).

[16] Mohapatra, P.K.J. (2010). *Software Engineering: A life cycle approach*. USA and Canada: New Age International (P) Ltd.

[17] Caspers, J. (10/2009). *Software Engineering Best Practices,* USA: McGraw-Hill.

[18] Stellman, A.; Greene, J. (2005). *Applied software project management.* Cambridge: O'Reilly Media.

[19] Sommerville, I. (2000). *Software Engineering*. *6th Edition*. New Delhi: Pearson Education Ltd.
New Delhi

[20] Pigosky, T. M. (1997). *Practical Software Maintenance*. New York: John Wiley & Sons.

[21] Merriman, D. (1996). *"Tying it all together"*. *Network World,* Boston: IDG Network World Inc.

[22] Beth, G.; William, R. A. (2005). *Enterprise integration, the essential guide to integration solutions*. New York: Addison Wesley.

[23] Scott, L.; Geoffrey, M.; Prewitt, Jr. R.; Michael, S. (2005). *Software Testing Techniques: Finding the defects that matter.* Boston MA: Charles River Media.

[24] Joseph M. (1998). *Quality in Software Development*. Boston: McGraw-Hill.

[25] Pallaw, V. K. (2010). *Database Management System.* 2nd Edition. New Delhi: Asian Books Private Ltd.

[26] Murthy, C.S.V. (2008). *Database management design.* New Delhi: Global Media.

[27] Introduction to Marketing. [www-document] Available at:

[Consulted: 29.11.2011]

[28] KamiCode-E-commerce Development. [www-document] Available at:
[Consulted: 29.11.2011]

[29] My virtual Model. [www-document] Available at:
[Consulted: 29.11.2011]

[30] Flyvbjer, R. (2006). *From Nobel Prize to Project Management*: *Getting Risks*. Aalborg: Aalborg University, Denmark.

[31] Dorfman, M. S.; Englewood, N.J. (2007). *Introduction to Risk Management and Insurance*, 9th Edition. New Jersey: Prentice Hall.

[32] Identify Theft. [www-document] Available at: [Consulted: 18.01.2012]

[33] Parnas, D. L. (1972). *On the Criteria To Be Used in Decomposing Systems into Modules.* Carnegie-Mello University, Pittsburgh: Association for Computing Machinery Inc.